

KVYATKOVSKIY, A.N.; YESIN, O.A.; ABDEYEV, M.A.; KHAN, O.A.

Possibility of reducing lead losses in slags by electrochemical
methods. Izv. AN SSSR. Otd. tekhn. nauk. Met. i topl. no.2:43-
48 Mr - Ap '61. (MIRA 14:4)
(Lead--Electrometallurgy)

NOVOKHATSKIY, I.A.; YASIN, O.A.; CHUCHMAREV, S.K.

Methods of determining the diffusion coefficient of hydrogen in
molten slags. Izv.vys.ucheb.zav.; chern.met. no.4:5-14 '61.
(MIRA 14:4)

1. Ural'skiy politekhnicheskiy institut.
(Slag) (Activity coefficients) (Hydrogen)

S/180/61/000/005/002/018
E071/E435

AUTHORS: Lepinskikh, B.M., Yesin, O.A., Manakov, A.I.
(Sverdlovsk)

TITLE: Electrolytic precipitation of chromium and vanadium
from molten slags

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye
tekhnicheskikh nauk. Metallurgiya i toplivo, no.5,
1961, 19-21

TEXT: An electrolytic separation of vanadium under reducing and oxidizing conditions as well as simultaneous precipitation of chromium and vanadium from a works' slag were investigated. In the initial experiments the starting slag contained 40% CaO, 15% Al₂O₃, 5% MgO and 40% SiO₂. To this slag an addition of 10 to 20% V₂O₅ or 5% Cr₂O₃ and 5% V₂O₅ was made. The electrolysis was carried out in corundum crucibles placed in a carbon resistance furnace heated to 1600°C. Tungsten wire was used for electrodes. It was found that under reducing conditions, the current efficiency for vanadium (about 80%) is practically independent of the current density. Under oxidizing conditions the current efficiency does not exceed 25%, probably due to the
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E071/E435

Electrolytic precipitation ...

oxidation of the reduced product by the gaseous phase. On simultaneous separation of chromium and vanadium with increasing current density, the current yield of vanadium sharply decreases and that of chromium remains practically constant. At a current density above 1.1 A/cm^2 , silicon begins to be reduced. This indicates that vanadium is mainly separated on the cathode at a current density below 1.1 A/cm^2 and mainly chromium is separated at a higher current density. The works waste slag on which the electrolytic separation of vanadium was tested had the following mean composition: 23% SiO_2 , 11% Cr_2O_3 , 1.2% V_2O_5 , 18% TiO_2 , 1.5% MgO , 2.5% Al_2O_3 , 1.6% CaO and 35% of total iron. Since electrolytic separation of iron is at present uneconomic, a preliminary reduction of iron with carbon is necessary. It was experimentally established that the slag had a melting temperature of 1520°C and that it was very viscous. To improve the reducing conditions the slag was mixed with 10% of a blast-furnace slag (40% CaO , 39% SiO_2 and 12% Al_2O_3). The slag mixture, with an addition of some charcoal (amount not specified) was melted in a 10 kg furnace and retained for 1.5 hours at 1500°C . The reduced

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Electrolytic precipitation ...

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metal contained 2.5 to 4% Cr and 0.5 to 0.7% V and the residual slag contained 0.2 to 0.3% V_2O_5 and 4 to 5% Cr_2O_3 . In the subsequent experiments, after retaining the charge for 1.5 hours at 1500°C, a graphite anode was immersed into the slag and a direct current was applied (current density 0.8 to 0.9 A/cm²). On the application of the current, the content of vanadium in the slag decreased to 0.09 to 0.10% and increased to up to 1% in the metal. It is concluded that the electrolytic method can improve the extraction of vanadium from slags. There are 3 figures and 3 Soviet references.

ASSOCIATION: Institut metallurgii UFAN SSSR
(The Institute of Metallurgy UFAN USSR)

SUBMITTED: May 13, 1961

Card 3/3

KHLYNOV, V.V.; YESIN, O.A.; NIKITIN, Yu.P.

Electrocapillary motion of sulfides in oxide melts. Izv.vys.ucheb.
zav.; khim.i khim.tekh. 4 no.1:53-56 '61. (MIRA 14:6)

1. Ural'skiy politekhnicheskii institut imeni S.M.Kirova, kafedra
teorii metallurgicheskikh protsessov.

(Sulfides) (Electrocapillary phenomena)

TOPORISHCHEV, G.A.; YESIN, O.A.; BRATCHIKOV, S.G.

Thermochemical characteristics of $PbO - SiO_2 - H_2O$ melts.
Izv. vys. ucheb. zav.; tsvet. mat. 4 no.3:37-43 '61. (MIRA 15:1)

1. Ural'skiy politekhnicheskiy institut, kafedra teorii
metallurgicheskikh protsessov.
(Lead sodium silicates--Thermal properties)

ORLOV, V.I.; YESIN, O.A.; SHURYGIN, P.M.; SHERSTOBITOV, M.A.

Investigation of processes in the interaction of chromium oxide
with silicon, manganese and iron by the electromotive force method.
Izv.vys.ucheb.zav.; chern.met. 4 no.5:28-36 '61. (MIRA 14:6)

1. Ural'skiy politekhnicheskiy institut.
(Chromium alloys—Electrometallurgy) (Electromotive force)

SRIVALIN, I.T.; YESIN, O.A.

Thermodynamic properties of silicate melts in the system
 $\text{FeO} - \text{CaO} - \text{SiO}_2$. Izv.vys.ucheb.zav; khim.i khim.tekh. 4 no.5:
825-831 '61. (MIRA 14:11)

1. Ural'skiy politekhnicheskii institut, kafedra teorii metall-
urgicheskikh protsessov.

(Silicates)

CHUCHMAREV, S.K.; YESIN, O.A.; BARMIN, L.N.

Cathodic behavior of hydrogen dissolved in molten oxides. Izv. vys.
ucheb. zav.; chern. met. 4 no.8:9-17 '61. (MIRA 14:9)

1. Ural'skiy politekhnicheskii institut.
(Slag) (Hydrogen-ion concentration)

SRIVALIN, I.T.; YESIN, O.A.

Dependence of the heat of mixing on composition. Izv.vys.ucheb.
zav.; chern.met. 4 no.9:13-20 '61. (MIRA 14:10)

1. Ural'skiy politekhnicheskiy institut.
(Liquid metals---Thermal properties)
(Heat of mixing)

NOVOKHATSKIY, I.A.; YESIN, O.A.; CHUCHMAREV, S.K.

Mechanism of hydrogen diffusion in slags. Izv. vys. ucheb. zav.;
chern. met. 4 no.10:10-18 '61. (MIRA 14:11)

1. Ural'skiy politekhnicheskii institut.
(Diffusion) (Slag)

NOVOKHATSKIY, I.A.; YESIN, O.A.; CHUCHMAREV, S.K.

Hydrogen solubility in molten slags. Izv. vys. ucheb. zav.; Chern.
met. 4 no.11:22-29 '61. (MIRA 14:12)

1. Ural'skiy politekhnicheskiy institut.
(Slag) (Hydrogen)

LEPINSKIKH, B.M.; YESIN, O.A.

Thermodynamic properties of the binary systems $PbO - B_2O_3$ and
 $MnO - B_2O_3$. Zhur.neorg.khim. 6 no.5:1223-1226 My ²⁶¹₆₁.
(MIRA 14:4)

(Lead oxide) (Boron oxide) (Manganese oxide)

06/01/012/005/020/028
E075/E555

AUTHORS: Dobinin, S.L., Yesin, O.A. and Vatolin, N.A.

TITLE: Magnetic susceptibility of liquid alloys

PERIODICAL: Fizika metallov i metallovedeniye, v.12, no.5, 1961,
763-765

TEXT: The authors studied the isotherms of the magnetic susceptibility χ of Fe-Mn, Fe-P and Mn-Si melts by means of the Faraday method. To exclude the possible influence on the magnetic field, the heater was in the form of a bifilar graphite tube. The alloy was placed into quartz ampoules with small holes at the end (0.5 to 1.0 mm). The magnetic susceptibility of pure iron and of manganese were determined for substances placed into alundum crucibles. The ampoules were suspended to analytical scales. The measurements were carried out in an argon atmosphere, which was carefully purified of oxygen (0.009% O_2), applying an excess pressure. The temperature was maintained at $1400 \pm 10^\circ C$ and was measured by a Pt/Pt Rh thermocouple. The magnetic field was maintained constant for each type of alloy within the limits of 400 to 7000 Oe. The ampoules were weighed at the temperatures of

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Magnetic susceptibility of ...

S/126/61/012/007/020/028
E073/E535

the experiment in presence and in absence of the magnetic field. From the weight difference the pulling force and the magnetic susceptibility were calculated. As starting materials for the Mn-Si alloys studied (containing 0 to 50 wt.% Si) 99.99% purity Mn and crystalline (99.99%) Si were used, the weight of the charge being about 15 g and the magnetic field intensity 6900 Oe. All the alloys studied were paramagnetic at the test temperature. It was found that the curve of the dependence of the magnetic susceptibility on concentration has a slight kink at 34% Si corresponding to the compound MnSi. Similar kinks were obtained also in earlier studies of the e.m.f. in the system Mn-C-Si. Fe-Mn alloys were produced from carbonyl iron and electrolytic manganese. The charge was again 15 g and a magnetic field of 5300 Oe was used. At the test temperature all the alloys were paramagnetic; the susceptibility increases linearly with increasing iron content and this is attributed to the absence of chemical compounds. The Fe-P alloys were produced by adding ferrophosphor (containing 25% P) to carbonyl iron. The charge was 6 g, the magnetic field 4200 Oe. At the test temperature all the specimens were again paramagnetic.

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The dependence of the susceptibility of the melts on concentration shows a kink at a P content of 22% corresponding to the compound Fe_2P ; the presence of this kink is in agreement with earlier published data on e.m.f. The obtained results show that, at 1400°C , iron is a stronger paramagnetic than manganese. The values of magnetic susceptibility for pure iron at 1400°C agree with those obtained by Vertman A.A., and Samarin A.M. (Ref.2: DAN SSSR, 1960, 134, No.2, 1326). The kinks on the curves χ vs. composition of the Mn-Si and Fe-P alloys are attributed to a sharp rise of the rate of increase of covalent bonds. Up to a composition corresponding to chemical compounds a relatively small part of the electrons pair off and the compounds MnSi and Fe_2P are paramagnetic compared to pure Fe and Mn. After forming chemical compounds the number of paired electrons starts to increase rapidly and the paramagnetism of the alloys decreases sharply. A known confirmation of this is the fact that solid MnSi_2 is diamagnetic and FeP is less paramagnetic than Fe_2P . Thus, the curves of the dependence of the magnetic susceptibility on concentration for liquid Mn-Si and Fe-P alloys give additional

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information, indicating the existence in these alloys of atom groupings corresponding to the alloys MnSi and Fe₂P. There are 1 figure and 12 references: 8 Soviet-bloc and 4 non-Soviet-bloc. The English-language references read as follows: Ref.3: Nakagawa Y.J. Phys.Soc. Japan, 1956, 7, No.8; Ref.5: Secksmith W., Rearce R.R. Proc. Roy.Soc., 1938, 167, 189; Ref.12: Shu-Cuiha J. Phys.Soc. Japan, 1960, 15, No.4, 581. ✓

ASSOCIATION: Institut metallurgii UFAN SSSR
(Institute of Metallurgy UFAS USSR)

SUBMITTED: May 5, 1961

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YESIN, O. A.

NOVOHATSKI, I. A. [Novokhatskiy, I. A.]; ESIN, O. A. [Yesin, O. A.];
CIUCIMAREV, S. K. [Chuchmarev, S. K.]

A method of determining the diffusion coefficient of hydrogen in
melted slag. Analele metalurgie 15 no.4:5-15 Q-D '61.

(Slag) (Hydrogen) (Diffusion)

S/076/61/035/012/003/008
B101/B138

AUTHORS: Musikhin, V. I., Yesin, O. A., and Lepinskikh, B. M.

TITLE: Use of solid electrolytes in emf measurements

PERIODICAL: Zhurnal fizicheskoy khimii, v. 35, no. 12, 1961, 2710 - 2712

TEXT: Slags used as electrolytes for the examination of melts in ferrous metallurgy by emf measurements have the drawback that they react with the cell walls making the measured emf values unstable. In a previous study (Zh. prikl. khimii, 31, 689, 1958), the authors obtained well reproducible emf values by using a mixture of Al_2O_3 with 5%

refractory clay as electrolyte: Al_2O_3 + clay Fe, C_{sat} , Al (2). In the present paper, the authors checked data obtained with this element and compared them with those obtained with a liquid slag of 40% CaO, 40% Al_2O_3 , 15% B_2O_3 , and 5% MgO. Results are given in the table: ✓

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Use of solid electrolytes...

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B101/B138

Emf of chain (2) at 1250°C

Liquid electrolytes			Solid electrolytes		
N_{Al}	E, mv	α_{Al}	N_{Al}	E, mv	α_{Al}
0.0036	304	0.0009	0.0036	320	0.0006
0.025	180	0.0159	0.0255	182	0.0152
0.067	127	0.0536	0.0865	120	0.0630

The almost identical values for solid and liquid electrolytes allow the calculation of emf from the equation $e = 0.1 \log(1/\alpha_{Al})$ (4). The emf values obtained with solid electrolytes are of high stability. There are 1 figure, 1 table, and 11 references: 9 Soviet and 2 non-Soviet.

ASSOCIATION: Institut metallurgii Ural'skogo filiala AN SSSR (Institute of Metallurgy of the Ural Branch AS USSR)

Card 2/2

YESIN, O.A., prof., doktor tekhn. nauk

Nature of silicate melts. Sbor. nauch. trud. Ural. politekh.
inst. no.122:29-39 '61. (MIRA 17:12)

S/020/61/136/002/029/034
B004/B056

AUTHORS: Musikhin, V. I. and Yesin, O. A.

TITLE: The Diffusion Coefficients of Ions in Molten Slags

PERIODICAL: Doklady Akademii nauk SSSR, 1961, Vol. 136, No. 2,
pp. 388-390

TEXT: The authors deal with the behavior of slags in electrolysis. In the present paper, they report on the determination of the diffusion coefficients of ions in molten aluminate slags (45% CaO, 47% Al₂O₃, 6% MgO, 2% B₂O₃), to which 2% Fe, Co, Si, Nb, V, Ti, and Zr were added and in silicate slags (40% CaO, 40% SiO₂, 20% Al₂O₃) with additions of Ni, Fe, V, Nb. Electrolyzer and electrodes were described in Ref. 6. Molten copper was used as cathode. Temperature was 1350-1550°C, the current density, 0.13-0.40 a/cm². Determination of the diffusion coefficient D was based upon the cathodic deposition being accompanied by concentration polarization. With a current density, i, being greater than the

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The Diffusion Coefficients of Ions in
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limiting current density, the concentration C_0 of the substance, which is reduced, decreases, and vanishes after a certain time t_0 . This may be found with an oscilloscope. D is calculated from t_0 , C_0 , and i :

$$D = 4i^2 t_0 / \pi C_0^2 n^2 F^2 \quad (1), \text{ where } n \text{ is the number of electrons in the}$$

elementary event of discharge. The change in the electrode potential was recorded by a loop oscilloscope, amplification being carried out by 6H9 (6N9) and 6P7 (6G7) tubes. Results are given in Fig. 1 as

$\log D = f(1/T)$. In each slag, two groups of ions could be distinguished.

The modifiers Fe, Co, Ni (first group), and also Ca (examined by other methods - Refs. 8-10) showed higher values of D than the net-forming elements of the second group: Si, Nb, V, Ti, Zr. The following holds:

$$D = D^0 \exp(-E/RT) \quad (2). \text{ The diffusion coefficients } D_I \text{ of aluminate slag}$$

are greater than D_{II} of silicate slag. D^0 was found for the first and

second ion groups in aluminate slag: $D_{I1} = 4.85$, $D_{I2} = 0.49$; in silicate

slag: $D_{II1} = 0.23$, $D_{II2} = 0.014$. According to the theory of the absolute

$$\text{reaction rate, } D^0 = (e\lambda^2 kT/h) \exp(\Delta S^*/R) \quad (3), \text{ where } \lambda \text{ is the distance}$$

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between neighboring equilibria of the diffusion particle; h is Planck's constant; ΔS^* is the activation entropy. From $\lambda_{ij} \exp(\Delta S_{ij}^*/2R) = \bar{u}_{ij}$ the following is calculated: $\bar{u}_{I1} = 22.2 \text{ A}$, $\bar{u}_{I2} = 7.0 \text{ A}$; $\bar{u}_{II1} = 4.8 \text{ A}$; $\bar{u}_{II2} = 1.2 \text{ A}$. The increased values obtained for I are explained by greater activation entropy ($\Delta S_I^* > S_{II}^*$). The difference between \bar{u}_{I1} and \bar{u}_{III} is explained by different motions of the cations. The net-forming cations move together with the large oxygen ions (Ref. 6). The diffusion of these cations depends on that of the small modifier ions and occupy only vacancies. Their transfer is therefore small (0.6 - 0.7 A) compared to the transfer of modifier ions from one equilibrium point to another (2.7 - 3.5 A). This explains the low values of D_2^0 compared to D_1^0 . There are 1 figure, 1 table, and 14 references: 9 Soviet, 2 US, 2 British, and 1 German.

ASSOCIATION: Institut metallurgii Ural'skogo filiala Akademii nauk SSSR
(Institute of Metallurgy of the Ural Branch of the Academy
of Sciences USSR)

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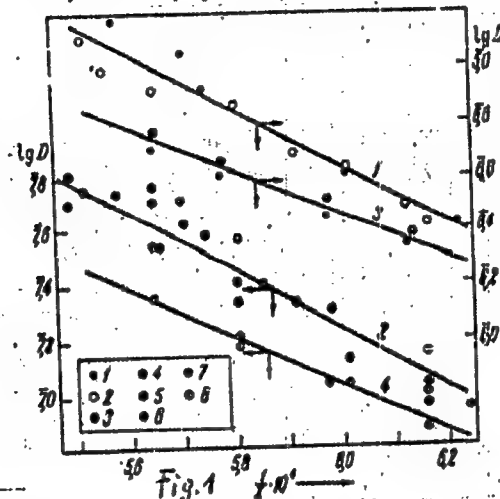
The Diffusion Coefficients of Ions in
Molten Slags

S/020/61/136/002/029/034
B004/B056

PRESENTED: July 20, 1960, by A. N. Frumkin, Academician

SUBMITTED: July 9, 1960

Legend to Fig. 1: 1: Fe, 2: Co, 3: Ni, 4: Si, 5: V, 6: Ti, 7: Zr, 8: Nb



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S/020/61/136/003/021/027
B004/B056

AUTHORS: Manakov, A. I., Yesin, O. A., and Lepinskikh, B. M.
TITLE: The Structure of the Surface Layer of Molten Niobates
PERIODICAL: Doklady Akademii nauk SSSR, 1961, Vol. 136, No. 3,
pp. 644-646

TEXT: The authors deal with the problem of the formation of electric double layers on the interface between melt and air. According to published data, mainly oxygen anions will be found on the surface of the melt. According to Ref. 8, however, a displacement of the oxygen anions by large monovalent alkali cations ought to be possible. It was the purpose of the present work to check this assumption experimentally. The method is based upon measuring the surface tension σ and the surface potential ϵ_s on the interface between melt and air in the systems $\text{Cs}_2\text{O} - \text{Nb}_2\text{O}_5$; ✓

$\text{K}_2\text{O} - \text{Nb}_2\text{O}_5$; and $\text{CaO} - \text{Nb}_2\text{O}_5$ at 1500°C , the concentration of Cs_2O , K_2O and CaO having been varied between 0 - 50 mole%. Experiments were made in a

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The Structure of the Surface Layer of
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furnace with carbon resistor. The cells with the substances were protected by means of a quartz tube against reducing atmosphere. σ was, according to Ref. 9, determined by measuring the maximum pressure in oxygen gas bubbles. ϵ_s was measured in the following electrolytic chain:

$\text{Pt} \mid \text{Nb}_2\text{O}_5 \mid \text{O}_2 \mid \text{Pt} \mid \text{O}_2 \mid \text{Nb}_2\text{O}_5 + \text{MeO} \mid \text{Pt}$. The external platinum electrodes were in

contact with Nb_2O_5 or $\text{Nb}_2\text{O}_5 + \text{MeO}$, respectively, which were in ZrO_2 crucibles. The middle electrode was in an oxygen current. The summational potential at the boundaries 6 (ϵ) and 5 (ϵ_s) was measured by means of the ППТБ-1 (PPTV-1) potentiometer, and referred to the potential ϵ_g of the gas electrode. $\Delta\epsilon = \epsilon + \epsilon_s - \epsilon_g > 0$. $\Delta\epsilon_0 = \epsilon_0 + \epsilon_s^0 - \epsilon_g$ remained constant.

The potential difference $\Delta\epsilon_1 = \epsilon_0 - \epsilon$ at the boundaries 1 and 6 was determined, the crucibles being connected with each other by means of a thin layer of liquid Nb_2O_5 . The following values were calculated:

$\Delta\epsilon_s = \epsilon_s^0 - \epsilon_s = \Delta\epsilon_0 - \Delta\epsilon - \Delta\epsilon_1$. The results are shown in Fig. 1. From

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The Structure of the Surface Layer of
Molten Niobates

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them the conclusion is drawn that the outer plate of the double layer is formed by oxygen anions. With increasing concentration of Cs^+ or K^+ ions, a partial substitution of the O^{2-} anions occurs. The number of cations adsorbed on the interface, their surface concentration N_s , was calculated according to two methods. 1) According to the Gibbs equation for ideal solutions: $\Gamma = -[N(1 - N)/RT] \partial \sigma / \partial N$; 2) on the basis of the change Δq of the surface charge on the assumption that the double layer may be put equal to a plane capacitor, and $C = 15 \text{ mf/cm}^2$; $\Delta q = \Delta \epsilon_s C$; $N'_s = \Delta q / 2nN_0 e$.

N_0 is the Avogadro's number, e the electron charge; the number 2 takes account of the number of ions in the molecule Me_2O . The results of these calculations are given in Table 1:

Oxide	N	$\cdot 10^{10} \text{ mole/cm}^2$ (calculated from σ)	N_s (calculated from σ)	N'_s (calculated from ϵ_s)	N'_s/N_s
Cs_2O	0.1	2.45	0.436	0.0228	0.052
K_2O	0.1	3.18	0.415	0.0112	0.027
CaO	0.1	-0.52	0.072	0.0003	0.004

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From the differences between N_s and N_i the following conclusions are drawn: The Me^+ ions replace, above all, niobium cations in the double layer, which are deeper and more distant from the surface than the O^{2-} anions. Only a small part of the Me^+ ions displaces O^{2-} ions from the surface. The adsorbed Me_2O are thus mainly orientated toward the surface with their oxygen anion. The more difficult displacement of the oxygen anions from the surface of the melt is explained by their easy polarizability. There are 1 figure, 1 table, and 13 references: 7 Soviet, 2 US, 1 French, 2 German, and 1 Roumanian.

ASSOCIATION: Institut metallurgii Ural'skogo filiala Akademii nauk SSSR
(Institute of Metallurgy of the Ural Branch of the Academy
of Sciences USSR)

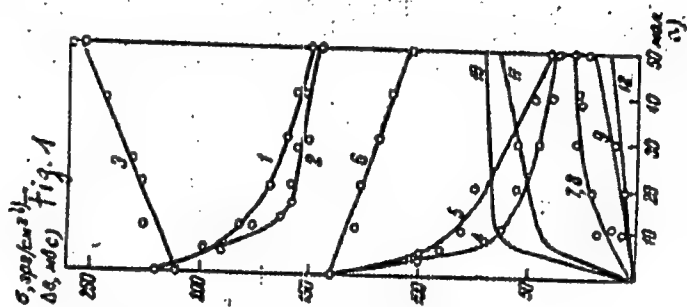
PRESENTED: July 20, 1960, by A. N. Frumkin, Academician

SUBMITTED: July 9, 1960

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S/020/61/136/003/021/027
B004/B056

Legend to Fig. 1. Isothermal lines of the surface tension and the change in the surface potential. 1,2,3: $\sigma=f(N)$ for systems of Nb_2O_5 with Cs_2O , K_2O and CaO , respectively; 4,5,6: $\Delta\epsilon=f(N)$; 7,8,9: $\Delta\epsilon_1 = -f(N)$; 10,11,12: $\Delta\epsilon_s = f(N)$ for the same systems. a) mole%, b) erg/cm², c) mv.



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S/020/61/136/004/022/026
B028/B060

AUTHORS: Novokhatskiy, I. A., Yesin, O. A., and Chuchmarev, S. K.

TITLE: Diffusion of Hydrogen in Molten Slag

PERIODICAL: Doklady Akademii nauk SSSR, 1961, Vol. 136, No. 4,
pp. 868-870

TEXT: Data available in the literature concerning the mass transfer of hydrogen in molten slag indicate very high values (10^{-3} - 10^{-2} cm² sec⁻¹). These data were obtained under the conditions prevailing in open-hearth furnaces, and rather stand for convection than for molecular diffusion D_H . To eliminate convection entirely and to approach the value for D_H , a nonsteady diffusion was used in the present work. An Al₂O₃ test tube contained a thin layer of viscous, liquid slag ($\delta = 1.5$ mm, $\eta = 3 - 100$ poises, 1410 - 1608°C) of the composition 16.5 - 53.0% CaO, 8.2 - 41.0% Al₂O₃, 6.0 - 58.3% SiO₂. Dried nitrogen was blown through to convey the water liberated from the slag to a hygrometer. The dew point was used to calculate the rate of water yielded by the slag. ✓

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Diffusion of Hydrogen in Molten Slag

S/O20/61/136/004/022/026
B028/B060

$Q_t/Q_0 \approx 1 - 8/\pi^2 e^{-\theta}$ (1). If θ is known, it is possible to calculate the diffusion coefficient. $D_H = \frac{4\delta^2\theta}{\pi^2\tau}$ (2). The values found for D_H assuming

three thicknesses of the slag layer (1.3; 1.8; and 2.6 mm) proved to be very high (1.0; 1.1; 0.9) $\cdot 10^{-5}$ cm²/sec. V_{H_2O} was not dependent upon the layer thickness. The fact that convection played no role in the experiment was checked with Lin' Tszya-tsziao (Ref. 3) and confirmed. The D_H found thus characterized the molecular diffusion of H_2 which was assumed to diffuse through the slag in the form of protons, and to pass over from one oxygen atom to another. This transition takes place only if the distance to the adjacent O atom does not exceed 2.65 Å, as occurs with SiO_2 ($d = 2.64$ Å). D_H was practically constant in slag with 56.4% SiO_2 . D_H rises with an increase of CaO and so does the activation energy. Due to

$$D = 2.72 \frac{kT}{h} \lambda^2 \exp(\Delta S^*/R) \exp\left(\frac{-E}{RT}\right). (\Delta S^* = \text{activation entropy, } \lambda \text{ distance})$$

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Diffusion of Hydrogen in Molten Slag

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between the equilibrium states of the moving particle), D_H and E may then increase at the same time, if λ rises. λ rises in CaO (lattice distance of the O atoms = 3.41 Å). In the case of slag rich in CaO, D_H amounted to $2.05 \cdot 10^{-5}$ cm²/sec, E = 20800 cal/mole. There are 3 figures and 16 references: 10 Soviet, 4 US, 1 Canadian, and 1 British.

ASSOCIATION: Ural'skiy politekhnicheskii institut im. S. M. Kirova,
Sverdlovsk (Ural Polytechnic Institute imeni S. M. Kirov,
Sverdlovsk) ✓

PRESENTED: July 20, 1960, by A. N. Frumkin, Academician

SUBMITTED: July 9, 1960

Card 3/3

S/149/62/000/001/001/009
A006/A101

AUTHORS: Toporishchev, G. A., Yesin, O. A., Bratchikov, S. G.

TITLE: Thermochemical investigation of $\text{PbO-Na}_2\text{O-SiO}_2$ melts

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya,
no. 1, 1962, 50 - 58

TEXT: To complete thermochemical data of the ternary $\text{Na}_2\text{O-PbO-SiO}_2$ system, enthalpy and heat capacity values were determined for melts corresponding to sections $\text{PbSiO}_3\text{-Na}_2\text{SiO}_3$, $\text{PbSiO}_3\text{-Na}_2\text{O}\cdot 3\text{PbO}\cdot 6\text{SiO}_2$ and $\text{Na}_2\text{O}\cdot 2\text{PbO}\cdot 3\text{SiO}_2\text{-Na}_2\text{Si}_2\text{O}_5$. The measurements were made on a unit with an adiabatic calorimeter by the method of mixing at 400 - 1,000°C, including both the solid and liquid state. The authors determined melting heats of compounds $\text{Na}_2\text{O}\cdot 3\text{PbO}\cdot 6\text{SiO}_2$, $\text{Na}_2\text{Si}_2\text{O}_5$ and $\text{Na}_2\text{SiO}_3\cdot 2\text{PbSiO}_3$, and the dissociation constant of the latter for Na_2SiO_3 and PbSiO_3 . The existence of phase transformation in solid specimens of the system $\text{Na}_2\text{SiO}_3\text{-PbSiO}_3$ at 820°K was observed. The nature of changes in the melting heats and the heat capacities with the composition, leads to the conclusion that there are atomic orderings in the melts, approaching the structure of $\text{Na}_2\text{SiO}_3\cdot 2\text{PbSiO}_3$ and $\text{Na}_2\text{O}\cdot 3\text{PbO}\cdot 6\text{SiO}_2$ compounds, and that there is a different degree of polymerization

Card 1/2

Thermochemical investigation of...

8/149/62/000/001/001/009
A006/A101

of silico-oxygen anions. There are 3 tables, 4 figures and 10 Soviet-bloc references.

ASSOCIATIONS: Ural'skiy politekhnicheskiy institut (Ural Polytechnic Institute)
Kafedra teorii metallurgicheskikh protsessov (Department of the
Theory of Metallurgical Processes) ✓

SUBMITTED: April 27, 1961

Card 2/2

YESIN, Oleg Alekseyevich; GEL'D, Pavel Vladimirovich; MIKULINSKIY, A.S.,
prof., doktor, retsenzent; BUR'KOV, M.M., red. izd-va; MATIYUK,
R.M., tekhn. red.

[Physical chemistry of pyrometallurgical processes] Fizicheskaya
khimiya pirometallurgicheskikh protsessov. Sverdlovsk, Metal-
lurgizdat. Pt.1. [Reactions between gaseous and solid phases]
Reaktsii mezhdu gazoobraznymi i tverdyimi fazami. 2., ispr. i
dop. izd. 1962. 671 p. (MIRA 15:10)

(Metals at high temperature)
(Chemistry, Physical and theoretical)

KVYATKOVSKIY, A.N.; YESIN, O.A.; SIZOV, Yu.M.; ABDEYEV, M.A.

Reducing copper losses in lead production slags by electrochemical
methods. Izv.AN SSSR. Otd.tekh.nauk. Met.i topl. no.4:40-43

Jl-Ag '62.

(MIRA 15:8)

(Copper) (Electrocapillary phenomena)

VATOLIN, N.A. (Sverdlovsk); YESIN, O.A. (Sverdlovsk); ABRAMOV, B.A.
(Sverdlovsk)

Investigating iron-vanadium melts by the electromotive force
method. Izv.AN SSSR. Otd.tekh.nauk. Mat.i topl. no.4:51-55
Jl-Ag '62. (MIRA 15:8)
(Iron-vanadium alloys--Electric properties)

SRVALIN, I.T.; YESIN, O.A.

Using quasi-chemical methods for metallurgical systems with ternary compounds. Izv.vys. ucheb. zav.; chern.met. 5:10-16 '62. (MIRA 15:10)

1. Ural'skiy politekhnicheskiy institut.
(Systems (Chemistry))

KORPACHEV, V.G.; POPEL', S.I.; YESIN, O.A.

Surface and volume viscosity of the simplest ferrous slags.
Izv. vys. ucheb. zav.; chern met. 5 no.1:41-47 '62.
(MIRA 15:2)

1. Ural'skiy politekhnicheskii institut.
(Slag)
(Viscosity)

KORPACHEV, V.G.; YESIN, O.A.; POPEL', S.I.

Effect of iron oxides on the viscosity, surface tension, and
density of commercial sodium silicate. Izv. vys. ucheb. zav.;
chern. met. 5 no.3:24-29 '62. (MIRA 15:5)

1. Ural'skiy politekhnicheskiy institut.
(Iron oxides) (Sodium silicate)

NIKITIN, Yu.P.; YESIN, O.A.; KHLYNOV, V.V.; SOTNIKOY, A.I.; KOROTCHENKOV, A.A.

Electrochemical investigation of the burning out of carbon. Izv.
vys. ucheb. zav.; chern. met. 5 no.5:16-24 '62. (MIRA 15:6)

1. Ural'skiy politekhnicheskiy institut.
(Liquid metals)
(Electrochemical analysis)

8/149/62/000/006/001/008
A006/A101

AUTHORS: Sryvalin, I. T., Yesin, O. A.

TITLE: On the temperature dependence of thermodynamical properties of metal solutions

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy, Tsvetnaya metallurgiya, 5
no. 6, 1962, 41 - 49

TEXT: In the theory of regular solutions and in the quasi-chemical method, the interchange energy W is usually considered to be independent of temperature. As a result, the excess isobaric potential of mixing $\Delta F'$, does not depend at all or very slightly upon the temperature. In fact, according to Soviet, American, and English data, W is a complicated function of temperature. The simplest way of improving the theory is to consider W as a linear function of temperature;

$$W = W_0 + T \frac{dW}{dT}$$

Card 1/2

S/149/62/000/006/001/008
A006/A101

On the temperature dependence of...

Several examples are given for binary metallic alloys which show the adequacy of this function to describe quantitatively the experimental data on heats and free energies of mixing. Variants of the existing theory are proposed which show the effect of local surrounding and the composition upon the energy of the interaction between particles. The correlations derived show well the behavior of various metal solutions with both low and high energy effects. A quantitative description is given of the thermodynamics of metal melts of Sn-Tl, Fe-Sn, Na-Sn, Na-Pb and Ni-Si systems. System Sn-Tl is related to the type of regular systems; the isobaric potential of Fe-Sn is described by an asymmetric curve; systems Na-Pb, Na-Si and Ni-Si obey the quasichemical formulae where ternary compounds are taken into account. In all the systems a noticeable temperature dependence of the excess isobaric potential of mixing $\Delta F'$ is observed; it can be well considered by the linear course of the interchange energy W with temperature. The predicted thermodynamical properties of the systems investigated are in a satisfactory agreement with experimental data. There are 5 tables.

ASSOCIATION: Permskiy politekhnicheskii institut (Perm' Polytechnic Institute).
Kafedra fizicheskoy i analiticheskoy khimii (Department of Physical
and Analytical Chemistry)

SUBMITTED:
Card 2/2

March 17, 1962

CHUCHMAREV, S.K.; YESIN, O.A.; DOBRYDEN', A.A.

Oxidation kinetics of slag sulfur by gaseous oxygen. Izv. vys.
ucheb. zav.; chern. met. 5 no.7:12-18 '62. (MIRA 15:8)

1. Ural'skiy politekhnicheskii institut.
(Sulfur) (Oxidation)

CHUCHMAREV, S.K.; YESIN, O.A.; NOVOKHATSKIY, I.A.

Hydrogen permeability through molten slags. Izv. vys. ucheb.
zav.; Chern. met. 5 no.10:5-13 '62. (MIRA 15:11)

1. Ural'skiy politekhnicheskiy institut.
(Slag) (Hydrogen)

SHURYGIN, P. M.; BARMIN, L. N.; YESIN, O. A.

Kinetics of oxide solution in molten silicates. Izv. vys.
ucheb. zav.; chern. met. 5 no.12:5-11 '62. (MIRA 16:1)

1. Ural'skiy politekhnicheskii institut.

(Oxides) (Silicates)

DOBRYDEN¹, A. A.; YESIN, O. A.; CHUCHMAREV, S. K.

Kinetics of the burning out of sulfur in slags during the passage of a direct electric current. Izv. vys. ucheb. zav.; chern. met. 5 no.12:12-19 '62. (MIRA 16:1)

1. Ural'skiy politekhnicheskiy institut.

(Slag—Sulfur content) (Electrolysis)

40201

S/078/62/007/009/006/007
B144/B101

24.7700

AUTHORS: Manakov, A. I., Yasin, O. A., Lepinskikh, B. M.

TITLE: Electrical conductivity of binary oxide systems containing niobium pentoxide

PERIODICAL: Zhurnal neorganicheskoy khimii, v. 7, no. 9, 1962, 2220-2225

TEXT: The electrical conductivity, κ , in binary systems of Nb_2O_5 with up to 50 mole-% K_2O , Li_2O , CaO , Al_2O_3 , Fe_2O_3 , or V_2O_5 was studied at 700 - 1600°C and found to be consistent with that of similar V_2O_5 systems. Pure V_2O_5 and Nb_2O_5 are electronic semiconductors in solid and liquid phase. The systems can be subdivided into: 1) Fe_2O_3 - Nb_2O_5 , V_2O_5 - Nb_2O_5 , where κ gradually increases with rising temperature; 2) all remaining systems with a break in the κ curve, which is characteristic of the melting of ionic conductors. For the K_2O - Nb_2O_5 system, the melting and solidification temperatures derived from the polytherms of κ are fairly

Card 1/2

Electrical conductivity of binary ...

S/078/62/007/009/006/007
B144/B101

consistent with those of its constitution diagram. Thus, preliminary constitution diagrams were established for all Me_aO_b systems. From data for the activation energies of the conductivity and of the equivalent conductivity of electrolytic melts, and for the viscosity, it is proved that in 1) the alloys are electronic conductors independent of their quantitative composition, whereas in 2) an increasing Me_aO_b content causes a transition from electronic to ionic conductivity. There are 2 figures and 5 tables.

ASSOCIATION: Ural'skiy filial Akademii nauk SSSR (Ural Branch of the Academy of Sciences USSR)

SUBMITTED: December 7, 1961

Card 2/2

DUBININ, E.L.; YESIN, O.A.; VATOLIN, N.A.

High-temperature melts of binary and pseudobinary systems on
the basis of iron and manganese. Zhur.neorg.khim. 7 no.12:2778-
2781 D '62. (MIRA 16:2)

(Iron-manganese alloys)

40679

S/126/62/014/002/013/018
E073/E535

18 8100.

AUTHORS: Dubinin, E.L., Yesin, O.A. and Vatolin, N.A.
TITLE: Concentration dependence of the magnetic susceptibility
of some liquid alloys
PERIODICAL: Fizika metallov i metallovedeniye, v.14, no.2, 1962, .
290-293

TEXT: In an earlier paper the authors discussed the results of measurements of the specific magnetic susceptibility χ of a number of carbon-free melts. Using the same measuring technique as before, the authors studied the dependence of χ on the composition of the following liquid alloys: Fe-P-C and Fe-C-Mn at 1400°C, Fe-Cr, Fe-C-Cr at 1400 and 1700°C, Fe-C at 1550°C and Mn-C at 1350 and 1550°C. The carbon-saturated alloys were produced from pig-iron made by smelting in graphite crucibles Armco iron, electrolytic manganese and the desired additions of other elements. 3-5 g charges of the samples to be investigated were placed in alundum crucibles and charged into the furnace. At this temperature all the alloys were paramagnetic. The composition of the alloys (wt.%) is given in the Table. The Card 1/4

Concentration dependence ...

S/126/62/014/002/013/018
EO73/E535

results are presented in the form of plots. Fig.1 shows the dependence of the magnetic susceptibility, $\chi \cdot 10^6$, as a function of the contents (wt.%) of C and P: 1 - Fe-P, 1400°C; 2 - Fe-C-P, 1400°C; 3 - Fe-C, 1550°C; 4 - Mn-C, 1350°C; 5 - Mn-C, 1550°C; 6 - Fe-P, 1400°C calculated on the basis of the validity of the additive law. Fig.2 shows the dependence of the magnetic susceptibility, $\chi \cdot 10^6$ as a function of the manganese and chromium contents (wt.%): 1 - Fe-Mn, 1400°C; 2 - Fe-Cr, 1400°C; 3 - Fe-C-Mn, 1400°C; 4 - Fe-C-Cr, 1400°C; 5 - Fe-Cr, 1700°C; 6 - Fe-C-Cr, 1700°C. There are 2 figures and 1 table.

ASSOCIATION: Institut metallurgii UFANa (Institute of Metallurgy, UFAN)

SUBMITTED: November 25, 1961 (initially)
April 21, 1962 (after revision)

Card 2/4

Concentration dependence ...

S/126/62/014/002/013/018
E073/E535

Composition of the alloys, wt. %

Fe-C		Fe-C-P		Fe-C-Mn		Mn-C		Fe-C-Cr		Fe-Cr
C		P	C	Mn	C	C		Cr	C	Cr
0,5		2,2	3,9	2,0	4,9	3,2		2,0	4,8	1,9
1,2		5,5	3,0	10,0	5,2	4,1		11,6	5,6	11,4
1,3		11,3	1,0	21,7	5,6	5,3		20,2	6,2	20,6
1,6		14,0	0,5	30,2	5,7	6,2		31,9	6,9	32,5
2,3		17,3	0,4	40,0	6,0	7,3		40,0	7,3	42,2
2,4		21,7	0,3	50,2	6,2	7,9		51,4	7,6	50,0
2,5		—	—	—	—	—		—	—	—
3,0		—	—	—	—	—		—	—	—
3,6		—	—	—	—	—		—	—	—
4,1		—	—	—	—	—		—	—	—
4,5		—	—	—	—	—		—	—	—

Card 3/4

Concentration dependence ...

S/126/62/014/002/013/018
E073/E535

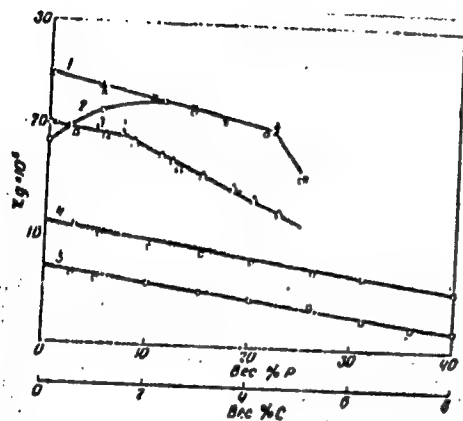


Fig. 1

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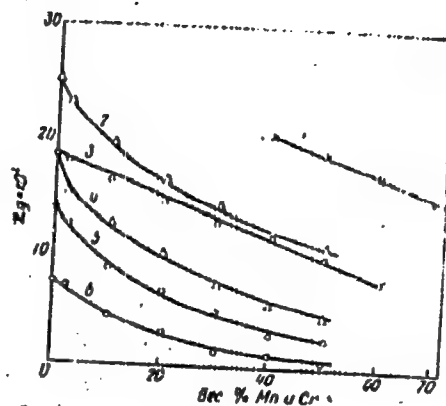


Fig. 2

8/126/62/014/004/016/017
E039/E435

AUTHORS: Dubinin, E.L., Yesin, O.A., Vatolin, N.A.
TITLE: Investigation of the magnetic susceptibility of Fe-Si,
Fe-P, Mn-Si at high temperatures
PERIODICAL: Fizika metallov i metallovedeniye, v.14, no.4, 1962,
589-594

TEXT: As comparatively little work has been done on investigating the change in magnetic susceptibility χ_g at temperatures well above the paramagnetic Curie point Θ_p for metals melting at 1300 to 1500°C, the dependence is studied in both the solid and liquid state of χ_g on temperature for the above alloys and for the steel X18H9T (Kh18N9T) (0.08% C, 0.45% Si, 0.83% Mn, 0.018% P, 0.015% S, 17.78% Cr, 9.98% Ni, 0.56% Ti) and Г13Л (G13L) (1.14% C, 0.73% Si, 11.80% Mn, 0.090% P, 0.011% S, 0.17% Cr, 0.18% Ni). The experimental method is as described in an earlier paper by the same authors. Armco iron, electrolytic manganese, crystalline silicon and ferro-phosphorus are used in preparing the alloys. Values of χ_g for Kh18N9T steel vary from 15.5×10^6 at 968°C to 13.8×10^6 at 1558°C and in the case of G13L steel from Card 1/2

Investigation of the magnetic ...

S/126/62/014/004/016/017
E039/E435

23.6 x 10⁶ at 687°C to 15.5 x 10⁶ at 1537°C. Curves showing the dependence of χ_g on composition at constant temperature have discontinuities at the points where the composition is equivalent to FeSi, Fe₂P and MnSi for the respective alloys. In general, the value of χ_g falls with increasing concentration of P and Si, although in the case of Fe-Si a maximum value of 45 x 10⁶ for χ_g is obtained for ~9% Si (1200°C) falling to ~3 x 10⁶ for 50% Si. The temperature dependence of 1/ χ_g is represented in each case by two straight lines corresponding to the solid and liquid states, showing that the Curie-Weiss law is obeyed in both conditions; different values of Θ_p are obtained for each state. In addition, the magnetic moment falls with increasing concentration of Si due to the strengthening of the covalent bonds. These results, which are in general agreement with those of other authors, provide additional information on the structure of these alloys and the nature of the intermolecular interactions. There are 4 figures and 3 tables.

ASSOCIATION: Institut metallurgii UFAN SSSR (Institute of Metallurgy
UFAN USSR)

SUBMITTED: May 9, 1962
Card 2/2

DUBININ, E.L.; YESIN, O.A.; VATOLIN, N.A.

Effect of electromagnetic forces on the removal of nonmagnetic
inclusions in liquid iron. Fiz.met.i metalloved. 14 no.6:935-
936 D '62. (MIRA 16:2)

1. Institut metallurgii Ural'skogo filiala AN SSSR.
(Steel--Inclusions) (Electromagnetism)

S/076/62/036/011/002/021
B101/B180

AUTHORS: Manakov, A. I., Yesin, O. A., and Lepinskikh, B. M. (Sverdlovsk)

TITLE: Surface tension, potential, and density of molten niobates

PERIODICAL: Zhurnal fizicheskoy khimii, v. 36, no. 11, 1962, 2317 - 2321

TEXT: In the systems $\text{Ca}_2\text{O} - \text{Nb}_2\text{O}_5$, $\text{K}_2\text{O} - \text{Nb}_2\text{O}_5$, $\text{Fe}_2\text{O}_3 - \text{Nb}_2\text{O}_5$ and $\text{CaO} - \text{Nb}_2\text{O}_5$ the surface tension and the density were determined by the method of maximum pressure in a gas bubble at 1450 - 1650°C, and ϵ_s the surface potential was measured in the $\text{Pt}|\text{Nb}_2\text{O}_5|\text{O}_2|\text{Pt}|\text{O}_2|\text{Nb}_2\text{O}_5 + \text{Me}_x\text{O}_y$ element at 1500°C. The basic oxides in these systems are present in industrial niobium ores and slags. Results: (1) When 10 mole% K_2O is added to Nb_2O_5 , σ falls from 220 to 170 erg/cm². Further K_2O addition causes only a slight further reduction. The system $\text{Ca}_2\text{O} - \text{Nb}_2\text{O}_5$ behaves similarly, and in the systems with CaO and Fe_2O_3 σ rises linearly with basic oxide concentration.

Card 1/3

S/076/62/036/011/002/021
B101/B180

Surface tension, potential, and density...

Thus, K^+ and Cs^+ show capillary surface-activity with respect to Nb_2O_5 .

(2) V the molar volumes of the melts $K_2O - Nb_2O_5$, $Fe_2O_3 - Nb_2O_5$ and $CaO - Nb_2O_5$ vary almost linearly with the composition. (3) The temperature coefficient $\gamma = d\sigma/dT$ of Nb_2O_5 is -0.01 , while it is $+0.01$ for V_2O_5 .

(4) The expansion coefficient $\beta = dV/dT$ is $24 \cdot 10^{-3}$ for Nb_2O_5 , $22 \cdot 10^{-3}$ for $K_2Nb_2O_6$, but only $5 \cdot 10^{-3}$ for V_2O_5 . (5) ϵ_s falls with increasing Me_2O concentration. At 10 mole% the reduction $\Delta\epsilon_s$ is ~ 65 mv for Cs_2O , 45 mv for K_2O and 2 mv for CaO . The Cs^+ and K^+ ions thus lie at the melt - gas interface. (6) Calculated by the Gibbs equation and from Δq the change in the charge assuming that the double layer is like a flat condenser, the surface concentration of atoms is different, suggesting that the adsorbed Ca_2O and K_2O oxides are orientated toward the surface mainly by their oxygen atoms, and only to a lesser extent (3 - 5%) by the Cs^+ or K^+ cations. There are 2 figures and 3 tables.

Card 2/3

Surface tension, potential, and density...

S/076/62/036/011/002/021
B101/B180

ASSOCIATION: Ural'skiy filial AN SSSR (Ural Branch of the AS USSR)

SUBMITTED: January 30, 1961

Card 3/3

S/076/62/036/012/008/014
B101/B180

AUTHORS: Manakov, A. I., Yesin, O. A., and Lapinskikh, B. M.
(Sverdlovsk)

TITLE: Thermoelectromotive forces and conductivity of vanadium and niobium pentoxides

PERIODICAL: Zhurnal fizicheskoy khimii, v. 36, no. 12, 1962, 2734 - 2740

TEXT: The paper describes measurements of the conductivity κ and the thermo-e.m.f. α in solid and liquid V_2O_5 and Nb_2O_5 , and of the Hall constant in V_2O_5 . The following results are given:

	V_2O_5		Nb_2O_5	
t°, C	600	1000(liq)	1200(sd)	1500(liq)
$\Delta E \cdot 10^{12}, \text{erg}$	1.58	2.73	3.56	6.42
n_1	$7.0 \cdot 10^{17}$	$9.16 \cdot 10^{16}$	$3.5 \cdot 10^{16}$	$7.3 \cdot 10^{14}$

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S/076/62/036/012/008/014
B101/B180

Nb₂O₅

Thermoelectromotive forces V ₂ O ₅			
n, cm ⁻³	n ₂ 4.1·10 ¹⁶	U _n 33	22
U, cm ² /v·sec	U ₁ 2.2	U _p 189	
α _{th} , μv/deg	U ₂ 38	-	1100
α _{exp} , μv/deg	α ₁ 820	-	950
	α ₂ 1030	200	
	~700		220

Δξ is the activation energy of conductivity, n is the number of current carriers, U their mobility. The subscripts 2 give values calculated from the Hall constant. Conclusions: The oxides studied are n-type semiconductors in both states of aggregation. In solid state, their forbidden band is narrower and extrinsic conduction prevails, which changes into intrinsic conduction on melting. As the Hall constant of V₂O₅ becomes negative at below 670°C, V₂O₅ is an anomalous semiconductor whose hole

S/076/62/036/012/008/014
B101/B180

Thermoelectromotive forces ...

mobility is higher than the electron. Goodman's rule stating that the width of the forbidden band in oxides of equal valencies increases with the energy of electrostatic interaction of ions, was also confirmed for $\text{CuO} - \text{CoO} - \text{MnO} - \text{MgO}$, $\text{Fe}_2\text{O}_3 - \text{Al}_2\text{O}_3$, and $\text{V}_2\text{O}_5 - \text{Nb}_2\text{O}_5$. There are 6 figures and 1 table.

ASSOCIATION: Ural'skiy filial AN SSSR, Ural'skiy politekhnicheskii institut (Ural Branch of the AS USSR, Ural Polytechnic Institute)

SUBMITTED: August 8, 1961

Card 3/3

34829

S/020/62/142/005/021/022
B110/B101

247700(13451137,1138

AUTHORS:

anakov, A. I., Yesin, O. A., and Lepinskikh, B. M.

TITLE:

Semiconductor properties of vanadium and niobium pentoxide in solid and liquid state

PERIODICAL:

Akademiya nauk SSSR. Doklady, v. 142, no. 5, 1962, 1124 - 1127

TEXT: The specific electroconductivity κ , the termo-emf, and the Hall constant of V_2O_5 and Nb_2O_5 were determined. The relatively high κ values and the absence of jumps on the polytherms when melting proved the semiconductor properties of V_2O_5 and Nb_2O_5 in both states. The activation energies calculated from $\kappa = \kappa_0 \exp(-\Delta E/2kT)$ are much higher for molten V_2O_5 and Nb_2O_5 than for solid ones since the intrinsic conductance is likely to prevail in the molten state but the impurity conductivity dominates in the solid state. At $< 0^\circ C$, $\kappa(V_2O_5)$ is very low ($T = -30^\circ C$;

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S/020/62/142/005/021/022
B110/B101

Semiconductor properties of...

$\chi \approx 10^{-5}$, $\Delta E = 0.72 \cdot 10^{-12}$) and is determined by accidental impurities. At higher temperatures, the activation energy increases due to partial dissociation of V_2O_5 to lower oxides ($\Delta E_{430^\circ C} = 1.56 \cdot 10^{-12}$). $\Delta E(Nb_2O_5)$ is greater than $\Delta E(V_2O_5)$, probably due to the stronger O-Nb bond. The number of current carriers in solid state is:

$n_{imp} = \sqrt{N_{imp}} \sqrt{2(2\pi m_n kT)^{3/2} / h^3} \cdot \exp(-\Delta E / 2kT)$. The effective electron mass m_n was equated to the mass at rest, the number N_{imp} of impurity centers to the number of low-valency cations determined by chemical analysis. Results obtained for $T = 130^\circ C$: $n_{imp 1} = 0.9 \cdot 10^{17}$; $T = 1000^\circ C$: $n_{imp 1} = 1.6 \cdot 10^{17}$; $T = 1100^\circ C$: $n_{imp 1} = 0.6 \cdot 10^{18}$. Since, for the impurity conductivity, χ is only determined by one type of current carriers, the mobility of the latter is: $u_n : K = neu_n$. $u_n(Nb_2O_5)$ is near the values for Cu_2O and ZnO ($u \approx 100$); $u_n(V_2O_5)$ is near that for TiO_2 ($u \approx 1$). For the

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Semiconductor properties of...

S/020/62/142/005/021/022
B110/B101

molten state, the number of current carriers is calculated from the equation for crystals: $n = \left\{ \left[2(2\pi m_n kT)^{3/2} / h^3 \right] \cdot \exp(-\Delta E / 2kT) \right\}$. The higher-heated part of the sample was charged positively. V_2O_5 and Nb_2O_5 have n-type conductivity. For the thermo-emf is:

$\alpha = (k/e) \cdot \left[r + 2 + \ln \left\{ 2(2\pi m_n kT)^{3/2} / n_t h^3 \right\} \right]$, where $r = 2$ in the scattering of electrons on impurity ions. As in other anomalous semiconductors, Mg_3Sb_2 , $ZnSb$, the decrease in thermo-emf with increasing temperature is probably due to partial compensation of the electron diffusion by hole conductivity. The thermo-emf consists of: (I) the difference of electrode potentials at the boundaries Pt|melt (heterogeneous effect, α_{het}), and (II) the potential drop between the hot and cold parts of the sample (homogeneous effect, α_{hom}). From

$$\alpha_{het} = 1/4F \left[\int_0^T c_{O_2} dT/T - \int_0^T 2/7 c_{V_2O_5} dt/T \right], \text{ the following was obtained:}$$

Card 3/5

Semiconductor properties of...

S/020/62/142/005/021/022
B110/B101

$\alpha_{\text{het}}(\text{liq}) = 325$; $\alpha_{\text{het}}(\text{sd}) = 394 \mu\text{v/deg.}$ Results of calculation:
 $\alpha_{\text{hom}}(\text{liq}) = -125$; $\alpha_{\text{hom}}(\text{sd}) = 300 \mu\text{v/deg.}$ α_{hom} caused by diffusion of
current carriers changes its sign during melting of V_2O_5 . The Hall
constant drops with temperature and changes its sign when passing through
the melting point of V_2O_5 (670°C). In the range of proper conductivity,
the negative sign of the Hall constant indicates electron conductivity.
There are 1 figure, 1 table, and 13 references: 6 Soviet and 7 non-Soviet.
The two references to English-language publications read as follows: J.
O'. M. Bockris, Modern Aspects of Electrochemistry, No. 2, N. Y.-London,
1959. P. L. Baynton et al., J. Electrochem. Soc., 104, No. 4, 237 (1957).

ASSOCIATION: Institut metallurgii Ural'skogo filiala Akademii nauk SSSR
(Institute of Metallurgy of the Ural Branch of the Academy
of Sciences USSR)

PRESENTED: October 9, 1961, by A. N. Frumkin, Academician

Card 4/5

CHUCHMAREV, S.K.; YESIN, O.A.; DOBRYDEN', A.A.

Effect of the electrode polarization on the properties of the
electrolyte-gas boundary. Dokl. AN SSSR 144 no.5:1100-1102
Je '62. (MIRA 15:6)

1. Ural'skiy politekhnicheskii institut imeni S.M.Kirova.
Predstavleno akademikom A.N.Frumkinym.
(Sulfur) (Combustion) (Polarization (Electricity))

MUSIKHIN, V.I.; YESIN, O.A.

Determination of diffusion coefficients of elements in liquid cast iron by oscillography at constant current. Dokl. AN SSSR 145 (MIRA 15:7)
no.2:360-362 JI '62.

1. Institut metallurgii Ural'skogo filiala AN SSSR. Predstavleno akademikom A.N. Frumkinym.
(D. ffusion) (Iron alloys)

SOTNIKOV, A.I.; YESIN, O.A.; NIKITIN, I.P.

"On Slow Discharge in Molten Oxides."

Report presented at the 14th meeting CITCE, Intl. Comm. of
Electrochemical Thermodynamics and Kinetics, Moscow, 19-25
Aug 63.

Polytechnical Institute, Sverdlovsk, U.S.S.R.

S/148/63/000/001/001/019
E039/E151

AUTHORS: Korpachev, V.G., Yesin, O.A., and Popel', S.I.
TITLE: The composition of surface layers in molten iron
containing oxides

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy,
Chernaya metallurgiya, no.1, 1963, 5-7

TEXT: As was previously found for the system FeO-Fe₂O₃, the surface of liquid melts can apparently remain heterogeneous even on superheating up to 200 °C above the liquidus. To examine the differences in composition between the surface layer and body of the melt, X-ray examinations were made of specimens taken from the top surface of a solidified cylinder (surface specimens) and from the centre of the cylinder (central specimens) using rotating polished specimens and Fe-K_α, β radiation. The results for a melt containing 11% Fe₂O₃ and 89% Fe (in iron crucible) showed that the central specimen gave only wüstite lines and weak magnetite lines, but the surface specimen showed only Fe₂O₃ and Fe₃O₄ lines. Similar results were obtained for the same melt, using a magnesia crucible either in vacuo or under argon. Similar investigations
Card 1/2

The composition of surface ...

S/148/63/000/001/001/019
E039/E151

were carried out for the following systems: 1) 70.1% FeO + 4.8% Fe₂O₃ + 25.1% SiO₂; 2) 64% FeO + 26.7% Fe₂O₃ + 9.3% CaO; 3) 59.1% FeO + 7.6% Fe₂O₃ + 22.3% SiO₂ + 11.0% MgO; 4) 78.8% FeO + 11.5% Fe₂O₃ + 9.7% Na₂O. The central specimen of system (1) showed lines close to those of fayalite, and the surface specimen an increased concentration of Fe₂O₃. Similar results were obtained for systems (2) and (3). Surface specimen of system (4) had Fe₂O₃, Fe₃O₄, Na₂Fe₂O₄ and FeO lines. Conclusion: the heterogeneity of surface layers in the systems studied is caused by increased concentration of Fe₂O₃. The introduction of sodium oxide into the melt causes some homogenisation of the surface layer and the body. There is 1 figure.

ASSOCIATION: Ural'skiy politekhnicheskiy institut
(Ural Polytechnical Institute)

SUBMITTED: October 23, 1962

Card 2/2

SERGIN, B.I. (Sverdlovsk); YESIN, O.A. (Sverdlovsk); LEPINSKIKH, B.M. (Sverdlovsk)

Kinetics of the interaction of copper sulfide and cuprous oxide. Izv. AN
SSSR. Otd. tekhn. nauk. Met. i gor. delo no.1:87-90 Jan'F '63.
(MIRA 16:3)

(Copper—Metallurgy)

LEPINSKIKH, B.M. (Sverdlovsk); YESIN, O.A. (Sverdlovsk); ANAN'IN, A.A.
(Sverdlovsk)

Studying the electromotive force in processes of cast iron
modification by magnesium addition alloys. Izv. AN SSSR. Otd.
tekhn. nauk. Met. i gor. delo no.4:117-120 JI-Ag '63. (MIRA 16:10)

KORPACHEV, V.G.; YESIN, O.A.; POPEL', S.I.

Evaluating the composition of surface layers in oxide melts. Izv.
vys.ucheb.zav.; Chernomet. 6 no.1:5-7 '63. (MIRA 16:2)

1. Ural'skiy politekhnicheskiy institut.
(Surface tension) (Metallic oxides)

NIKITIN, Yu.P.; YESIN, O.A.; SOTNIKOV, A.I.

Ferrotungsten recovery from waste slags with the help of
electric currents. Izv. vys. ucheb. zav.; chern. met. 6
no.2:12-15 '63. (MIRA 16:3)

1. Ural'skiy politekhnicheskiy institut.
(Slag)
(Iron-tungsten alloys)
(Electrocapillary phenomena)

TOPORISHCHEV, G.A.; YESIN, O.A.

Thermochemical characteristics of manganese silicates.

Izv. vys. ucheb. zav.; chern. met. 6 no.2:16-22 '63.
(MIRA 16:3)

1. Ural'skiy politekhnicheskiy institut.
(Manganese silicates--Thermal properties)

DOBRYDEN', A.A.; YESIN, O.A.; CHUCHMAREV, S.K.

Effect of alternating current on the rate of the burning-out of
sulfur from slag. Izv. vys. ucheb. zav.; chern. met. 6 no.3:
20-25 '63. (MIRA 16:5)

1. Ural'skiy politekhnicheskiy institut.
(Desulfuration) (Electric currents, Alternating)

CHUCHMAREV, S.K.; YESIN, O.A.

Form of hydrogen existence in molten slags. Izv. vys. ucheb. zav.;
chern. met. 6 no.4:12-19 '63. (MIRA 16:5)

1. Ural'skiy politekhnicheskii institut.
(Slag—Testing) (Hydrogen ion concentration)

TOPORISHCHEV, G.A.; YESIN, O.A.; KALUGIN, V.N.

Anodic polarization of silicon in the system copper-slag. Izv.
vys. ucheb. zav.; tsvet. met. 6 no.4:64-70 '63. (MIRA 16:8)

1. Ural'skiy politekhnicheskiy institut, kafedra teorii
metallurgicheskikh protsessov.
(Polarization (Electricity))
(Systems (Chemistry))

SRYVALIN, I.T.; YESIN, O.A.

Using the quasi-chemical method for liquid iron-silicon alloys.
Izv. vys. ucheb. zav.; Chern. met. 6 no.5:5-9 '63. (MIRA 16:7)

1. Permskiy politekhnicheskiy institut.
(Iron-silicon alloys—Thermal properties)

POPEL', S.I.; YESIN, O.A.; DZHEMILEV, N.K.

Adhesion of carbon iron alloys to slags. Izv. vys. ucheb. zav.;
chern. met. 6 no.6:5-10 '63. (MIRA 16:8)

1. Ural'skiy politekhnicheskiy institut.
(Iron alloys) (Surface tension)

SOTNIKOV, A.I.; YESIN, O.A.; NIKITIN, Yu.P.

Electrochemical investigation of the decarburization reaction
in kinetic conditions. Izv. vys. ucheb. zav.; Chern. met. 6
no.8:19-23 '63. (MIRA 16:11)

1. Ural'skiy politekhnicheskiy institut.

POPEL', S.I.; DERYABIN, A.A.; YESIN, O.A.

Surface properties of oxide systems composing the deoxidation
products of ball bearing steel. Izv. vys. ucheb. zav.; chern.
met. 6 no.12:5-8 '63. (MIRA 17:1)

KVYATKOVSKIY, A.N.; SIZOV, Yu.M.; YESIN, O.A.; ABDEYEV, H.A.

Electrochemical extraction of copper from slag with the fuming process
equipment of the lead industry. Trudy Alt. GMI AN Kazakh. SSR 14:
52-58 '63. (MIRA 16:9)
(Lead industry—By-products) (Copper—Electrometallurgy)

S/126/65/015/002/010/035
B193/E305

AUTHORS: Vatolin, N.A., Vostryakov, A.A. and Yesin, O.A.

TITLE: Viscosity of liquid iron-carbon alloys

PERIODICAL: Fizika metallov i metallovedeniye, v. 15, no. 2,
1963, 222 - 228

TEXT: The method of attenuation of torsional oscillations of a crucible containing the molten alloy was used to determine the effect of composition and temperature on the viscosity of iron-carbon alloys. The experimental materials contained up to 5% C and the tests were conducted at 1270 to 1720 °C. The results (side-by-side with those obtained by other workers) are reproduced in Fig. 2, where the viscosity ($\eta \times 10^3$ poise) is plotted against the C content of the alloy, the various curves relating to data obtained by: 1-Barfield and Kitchener (J. Iron and Steel Inst., 1955, 4, 324); 2-Turovskiy and Lyubimov (Izv. vuzov, Chernaya metallurgiya, 1960, no. 2, 15); 3-Wen Li-Shih and Arsent'yev (Izv. vuzov, Chernaya metallurgiya, 1961, no. 7, 5); 4-Thielman and Wimmer (Stahl. u. Eisen, 1927, 47, 389); 5 to 8 - the present authors in tests at 1500, 1550, 1600 and 1650 °C ;
Card 1/3

Viscosity of

S/126/63/C15/002/C10/033
E195/E383

curve 9 represents the concentration-dependence of the free volume ($\text{cm}^3/\text{g.at.}$, right-hand scale) of the alloy. It will be seen that at each test temperature η sharply decreases as the C content increases from 0 to 0.2%, remaining practically constant in the 0.2 to 2.2% C range and then decreasing again. Although the variation in η qualitatively follows the concentration-dependence of the free volume of the alloy, there is no quantitative agreement. This and other considerations led the present authors to the conclusion that the shape of the viscosity isotherms of iron, carbon and other alloys could not be explained by the free-volume of the liquid increasing with increasing carbon content, and that the specific change in the energy of the atomic interaction, brought about by increasing the carbon content in the melt, was of much greater importance. There are 2 figures and 1 table.

ASSOCIATION: Institut metallurgii UFAN SSSR (Institute of Metallurgy, UFAN, USSR)

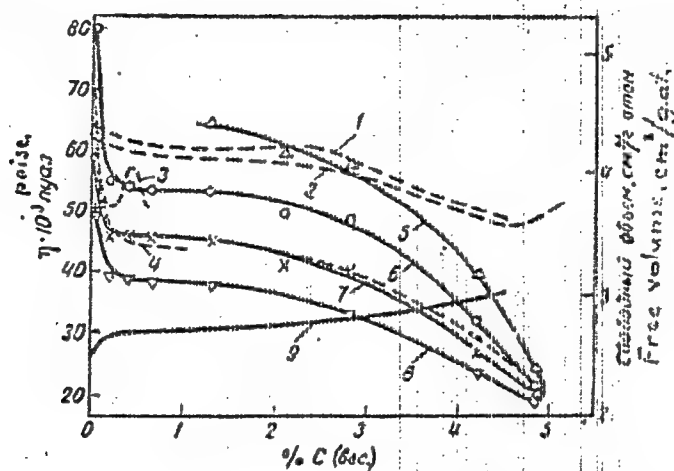
SUBMITTED: July 11, 1962

Card 2/3

Viscosity of

S/126/65/011/002/010/033
E193/E383

Fig. 2:



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ACCESSION NR: AP4004688

S/0126/63/016/005/0675/0680

AUTHORS: Vostryakov, A. A.; Vatolin, N. A.; Yesin, O. A.

TITLE: Viscosity and electrical resistance of molten chromium alloys

SOURCE: Fizika metallov i metallovedeniye, V. 16, no. 5, 1963, 675-680

TOPIC TAGS: molten chromium alloy, chromium alloy, viscosity, electrical resistance, composition, molten alloy, molten alloy viscosity, molten metal viscosity

ABSTRACT: The variation of kinematic viscosity and electrical resistivity of liquid Cr-alloys with Fe, C, and Al with respect to temperature and Cr content was studied by the torsional oscillation method (of crucible with the melt). The alloys were prepared of technically pure iron, chromium obtained by the aluminothermic method, electrolytic aluminum, and pure graphite. These materials were melted in a resistance oven filled with helium. Kinematic viscosity and electrical resistivity were calculated by the Ye. G. Shvidkovskiy (Nekotoryye voprosy vyazkosti rasplavlennykh metallov, GITTL, 1955) and A. R. Regel' (ZhTF, 1948, 18, 1511) formulas. It was established that: 1) the viscosity and activation energy isotherms of liquid Fe-Cr had minima corresponding to those on the line of liquidus; 2) the viscosity of carbon-free ferrochromia increased suddenly at a Cr content

Card 1/2

ACCESSION NR: AP4004688

exceeding 40% due to the ability of the alloy to absorb gases and to enter into reactions with refractory materials; 3) the viscosity of a carbon-saturated ferrochrome increased considerably at 1550C; this is explained by the separation of the solid carbon phase; 4) the viscosity of ferrochrome containing 5% of C showed a stronger increase with the increase in Cr concentration than in the Fe-Cr system; this is assumed to be due to the formation of chromium carbides; 5) the viscosity isotherms of the Fe-C system had a minimum at 3.5% C; the increase in temperature from 1400 to 1600C caused the rise in the minimum; 6) the electrical resistance of carbon-free ferrochrome is somewhat lower than that of the carbon-containing alloys. In both cases the resistance is almost independent of the Cr content. Orig. art. has: 2 tables and 4 figures

ASSOCIATION: Institut metallurgii UFAN SSSR (Institute of Metallurgy UFAN SSSR)

SUBMITTED: 17May63

DATE ACQ: 03Jan64

ENCL: 00

SUB CODE: ML

NO REF SOV: 015

OTHER: 007

Card 2/2

VATOLIN, N.A.; YESIN, O.A.

Density of liquid manganese alloys with silicon, iron, and carbon.
Fiz. met. i metalloved. 16 no.6:936-937 D '63. (MIRA 17:2)

1. Institut metallurgii Ural'skogo filiala AN SSSR.

1597-63

EWB : EWI : SOS -FFTC-ASD LD

5/20/63 10:12

AUTHOR: Pavlov, V. V., Popel', B. I., Yesin, C. A.

TITLE: Calculation of the surface tension of liquids from the excess isochore-isotherm potential. II. Molten salts and metals

PERIODICAL: Zhurnal fizicheskoy khimii, V. 37, No. 4, 1963, 797-801

TEXT: With the use of the excess isochore-isotherm potential an equation is derived which correlates the surface temperature of ionic liquids with the temperature, volume, and saturated vapor pressure. Thus

$$\sigma = 0.157 (1 + 89)T \frac{4.53 + \lg(T/V) - \lg P}{V_{\text{liq}}^{2/3}} \quad (7)$$

Here T is the temperature; V is the volume; and P is the saturated vapor pressure. The values for σ and $d\sigma/dT$ calculated for molten salts are in satisfactory agreement with the experimental data. An equation derived earlier for molecular liquids can be applied to estimate the surface tension of metals which have a simple cubic structure. The equation is

Card 1/2

L 16918-63

S/074/63/037/004/018.024

Calculation of the surface tension of liquids from ...

$$\sigma = 1/6 \frac{RT \left[\ln \left(\frac{RT}{PV_{liq}} \right) - 1 \right]}{N_0^{1/3} v_{liq}^{2/3}} \quad (9)$$

N_0 is the number of non-interacting particles. RT is the change of the mole in-
chore potential. Satisfactory agreement between calculated and experimental data
also occurs here. There are 2 tables.

ASSOCIATION: Ural'skiy politekhnicheskii institut imeni S. M. Kirova (Ural Poly-
technical Institute imeni S. M. Kirov), Sverdlovsk

SUBMITTED: March 12, 1962

Card 2/2

YESIN, O.A.; GEL'D, P.V.; POPEL', S.I.; NIKITIN, Yu.P.

Review of "Physical chemistry" by A.A. Zhukhovitskii and
L.A. Shvartsman. Zhur. fiz. khim. 37 no.6:1435-1436 Je '63.
(MIRA 16:7)

1. Ural'skiy politekhnicheskii institut imeni S.M. Kirova.
(Zhukhovitskii, A.A.) (Shvartsman, L.A.)
(Chemistry, Physical and theoretical)

CHUCHMAREV, S.K.; YESIN, O.A.; PASTUKHOV, E.A.

Form in which trivalent iron ions occur in molten silicates. Dokl.
AN SSSR 150 no.5:1094-1096 Je '63. (MIRA 16:8)

1. Ural'skiy politekhnicheskii institut im. S.M.Kirova.
Predstavleno akademikom A.N.Frumkinym.
(Iron compounds) (Silicates)

POPEL', S. I.; PAVLOV, V. V.; YESIN, O. A.

Calculation of the surface tension of liquids by means of the
excess isochore-isotherm potential. Part 1. Zhur. fiz. khim.
37 no. 3:622-627 Mr '63. (MIRA 17:5)

1. Ural'skiy politekhnicheskii institut imeni Kirova, Sverdlovsk.

BORONENKOV, V.N.; YESIN, O.A.; SHURYGIN, P.M.

Cathodic processes on a disk electrode in oxide melts. Dokl. AN
SSSR 151 no.4:872-874 Ag '63. (MIRA 16:8)

1. Ural'skiy politekhnicheskiy institut im. S.M.Kirova.
Predstavleno akademikom A.N.Frumkinym.
(Electrodes) (Metallic oxides)

SOTNIKOV, A.I.; YESIN, O.A.; NIKITIN, Yu.P.

Chemical polarization at high temperatures. Dokl. AN SSSR 152
no.5:1173-1176 0 '63. (MIRA 16:12)

1. Ural'skiy politekhnicheskiy institut im. S.M.Kirova.
Predstavleno akademikom A.N.Frumkinym.